Memorandum

MIAMI-DADE COUNTY

Date: February 6, 2007

Agenda Item No. 8(R)(1)(A)

To: Honorable Chairman Bruno. A. Barreiro and Members, Board of County Commissioners

From: George M. Burgess
County Manager

Subject: Agreement with the United States Geological Service to Conduct a Groundwater Study at the North District Wastewater Treatment Plant

RECOMMENDATION

It is recommended that the Board of County Commissioners (Board) adopt the attached resolution approving a Joint Funding Agreement between the Miami-Dade County and the U.S. Geological Survey (USGS) to conduct groundwater studies of the Floridan Aquifer in the vicinity of the North District Wastewater Treatment Plant (NDWWTP).

BACKGROUND

The Miami-Dade Water and Sewer Department (MDWASD) operates the NDWWTP located at 2575 NE 151 Street in northeast Miami-Dade County. The NDWWTP disposes of treated wastewater primarily by ocean outfall and by underground injection wells into the Lower Floridan Aquifer at depths below 2,400 feet.

In July 1997, water quality samples taken during the construction of two of the underground injection wells detected the presence of ammonia, an indicator of wastewater at and below 2,160 feet in the Upper Floridan Aquifer. In March 1998, ammonia was also detected in the 1500 foot monitoring zone which was interpreted by the Florida Department of Environmental Protection (FDEP) as a potential indication of fluid movement. Federal and state laws and regulations prohibit fluid movement from the injection zone. MDWASD concluded that in both cases, the detection of ammonia was probably the result of a one-time construction-related injection event in 1997, and not the result of upward fluid migration.

MDWASD conducted tests to determine the origin of the upward fluid migration and submitted the results to FDEP in June 2000 along with a "Purging Plan" to remediate the ammonia in the upper zone. Several purging plan revisions were submitted to the FDEP during the next two years, and the "Purging Plan" was approved by FDEP on July 30, 2002. Purging commenced in March 2003 and ceased in April 2004 as the estimated amount of ammonia introduced into the Floridan Aquifer during construction had been purged. The two underground injections wells in question operated for two years under FDEP operational testing permits which require MDWASD to conduct weekly water quality samplings and analysis of the data collected. This type of study was performed between 2004 and 2006, after the purging and while the injection wells were being used. During this two year time period, MDWASD concluded that no migration was occurring, verifying the earlier conclusion that the ammonia was introduced during construction.

In 2006, MDWASD staff, presented evidence to FDEP based on the results of the required weekly water quality samplings. The factual evidence indicates that the ammonia detected in the monitoring

wells was construction related and not the result of upward fluid movement in the Floridan Aquifer. In response to MDWASD's assessment, FDEP proposed to issue MDWASD two 2-year construction permits for the continued operation of both underground injection wells contingent on MDWASD completing a groundwater study with the USGS. The groundwater study USGS will conduct with MDWASD includes numerical modeling and water quality analysis to confirm or refute the hypothesis of upward fluid migration in the injection system at the NDWWTP. The total cost of the study is $1,052,107, of which MDWASD will fund $752,107 and USGS the remaining $300,000.

Once conclusive evidence from the groundwater study is presented to FDEP confirming there is no upward fluid migration as a result of the operation of the underground injection well system at the NDWWTP, it will allow MDWASD to continue to use injection as an operating permit condition without the additional expense of high level disinfection treatment to the treated wastewater prior to injection as an operating permit condition.

Assistant County Manager

MEMORANDUM

(Revised)

TO: Honorable Chairman Bruno A. Barreiro and Members, Board of County Commissioners

DATE: February 6, 2007

FROM: Murray A. Greenberg, County Attorney

SUBJECT: Agenda Item No. 8(R)(1)(A)

Please note any items checked.

_____ **"4-Day Rule" ("3-Day Rule" for committees) applicable if raised**

_____ **6 weeks required between first reading and public hearing**

_____ **4 weeks notification to municipal officials required prior to public hearing**

_____ **Decreases revenues or increases expenditures without balancing budget**

_____ **Budget required**

_____ **Statement of fiscal impact required**

_____ **Bid waiver requiring County Manager's written recommendation**

_____ **Ordinance creating a new board requires detailed County Manager's report for public hearing**

_____ **Housekeeping item (no policy decision required)**

_____ **No committee review**

Approved _____ Mayor

Veto _____

Override _____

Agenda Item No. 8(R)(1)(A)

02-06-07

RESOLUTION NO. _____

RESOLUTION APPROVING A JOINT FUNDING AGREEMENT BETWEEN MIAMI-DADE COUNTY AND U.S. GEOLOGICAL SURVEY ("USGS") TO CONDUCT A GROUNDWATER STUDY OF THE FLORIDAN AQUIFER AT THE NORTH DISTRICT WASTEWATER TREATMENT PLANT

WHEREAS, this Board desires to accomplish the purposes outlined in the accompanying memorandum, a copy of which is incorporated herein by reference,

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF COUNTY COMMISSIONERS OF MIAMI-DADE COUNTY, FLORIDA, that the County Manager is hereby authorized, for and on behalf of Miami-Dade County, to execute the Joint Funding Agreement between Miami-Dade County and the USGS, in substantially the form attached hereto, and to exercise the provisions thereof.

The foregoing resolution was offered by Commissioner , who moved its adoption. The motion was seconded by Commissioner and upon being put to a vote, the vote was as follows:

Bruno A. Barreiro, Chairman
Barbara J. Jordan, Vice-Chairwoman

Jose "Pepe" Diaz	Audrey M. Edmonson
Carlos A. Gimenez	Sally A. Heyman
Joe A. Martinez	Dennis C. Moss
Dorrin D. Rolle	Natacha Seijas
Katy Sorenson	Rebeca Sosa
Sen. Javier D. Souto	

The Chairperson thereupon declared the resolution duly passed and adopted this 6th day of February, 2007. This resolution shall become effective ten (10) days after the date of its adoption unless vetoed by the Mayor, and if vetoed, shall become effective only upon an override by this Board.

MIAMI-DADE COUNTY, FLORIDA
BY ITS BOARD OF COUNTY
COMMISSIONERS

HARVEY RUVIN, CLERK

By:_____
Deputy Clerk

Approved by County Attorney as
to form and legal sufficiency:

David M. Murray

PROJECT PROPOSAL

Fate and Transport of Deep Well Injectate at the North District Wastewater Treatment Plant, Miami, Florida

In cooperation with the Miami-Dade Water and Sewer Department

Prepared by:

U.S. Geological Survey
Florida Integrated Science Center--Fort Lauderdale
3110 SW 9th Avenue
Fort Lauderdale, FL 33315

October 31, 2006

INTRODUCTION

As part of an agreement with the Florida Department of Environmental Protection (FDEP) to issue an operational permit for injection wells IW-2 and IW-3 at the North District Wastewater Treatment Plant (NDWWTP), the Miami-Dade Water and Sewer Department (MDWASD) is proceeding with the development of a numerical groundwater flow and solute transport model for the site. The model development, which is described here, will be performed by the U.S. Geological Survey (USGS) and will follow a procedure similar to that being used for a companion study of the South District Wastewater Treatment Plant (SDWWTP). In addition, the study will include a water quality analysis to confirm or refute the hypothesis that upward movement of treated wastewater at the site was a one-time event caused by injection testing.

MDWASD presented to the FDEP in a meeting held on April 13, 2006 geochemical evidence that the detected ammonia in the 1500 ft zone for the Floridan Aquifer was the result of a one-time injection event while the wells were still under construction, and not the result of upward fluid migration. As there was no evidence of upward fluid migration through a confining unit, MDWASD proposed that additional treatment of the injectate prior to injection would not be warranted as part of the operational permit to be issued by the FDEP. The FDEP agreed with a proposal by MDWASD to complete the numerical model as part of the operational permit, without the requirement of additional injectate treatment at this time.

Background

The NDWWTP, located in eastern Miami-Dade County about 4 miles south of the Broward County border, treats wastewater at an average annual rate of about 100 MGD. Currently, most of this treated wastewater is released as ocean outfall with a small amount distributed as reuse water. As an alternative to ocean outfall, the County has installed four deep injection wells that are open about 3,000 feet below land surface (bls) in the highly transmissive Boulder Zone part of the saline Lower Floridan Aquifer. Monitoring wells were also installed at two different depths (about 1,100 and 1,500 feet bls) above the injection wells to test for any upward fluid movement. Currently, the County is in the process of applying for operational use permits from FDEP, which would allow the wells to be used for wastewater disposal. Injection of treated wastewater at the NDWWTP has occurred intermittently since the mid 1990's as part of well construction and testing. During one of the testing events, treated wastewater appears to have migrated upward into the 1,500-foot monitoring zone.

Starting on June 15, 1997, treated wastewater with an average ammonia (NH_3) concentration of about 18 mg/l was injected into the Lower Floridan Aquifer through injection wells IW-2 and IW-3 (Figure 1). On June 20, 1997, injection ceased after a total of about 120 million gallons of treated wastewater had been injected. The average injection rate for the five-day period was about 12 million gallons per day (MGD). During this five-day period injection well, IW-1, was under construction and an open borehole seems to have connected the injection zone (about 3000 ft below land surface; bls) with the flow zone at about 1500 ft bls. This hydraulic connection remained open

until the construction of IW-1 was completed shortly thereafter. Ammonia concentrations in monitoring wells open at 1,500 ft suggest that a plume of treated wastewater moved upward into the 1,500-foot monitoring zone during the period when IW-1 was under construction, and then moved radially outward from IW-1.

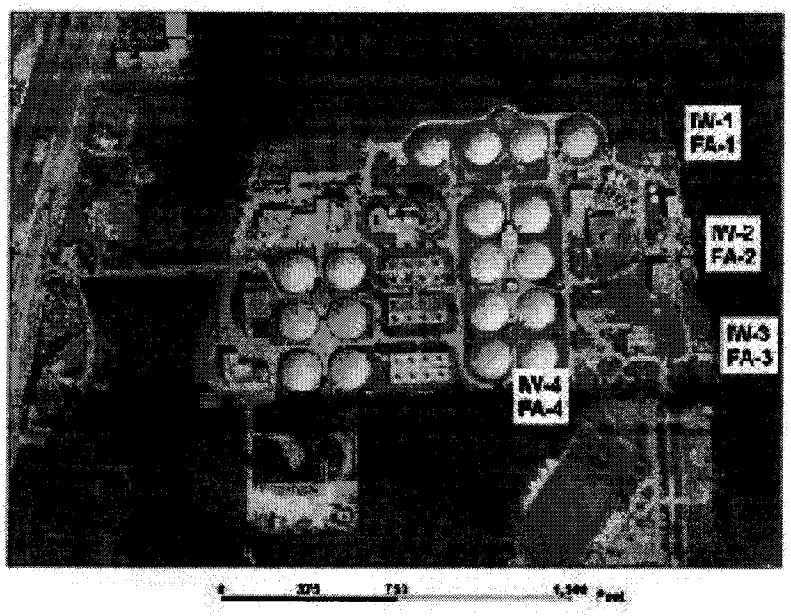

Figure 1. Aerial photograph of the North District Wastewater Treatment Plant showing the location of the injection and monitoring wells.

Since the 1997 injection event, NH_3 concentrations in the lower zone monitoring wells suggest that a plume of treated wastewater has moved radially outward from IW-1. During the first half of 1998, NH_3 concentrations started to increase at FA-1L, which is the lower zone monitoring well located about 75 ft from IW-1 (Figure 2). During the second half of 1998, NH_3 concentrations also started to increase at FA-2L (about 500 ft from IW-1), and then at FA-3L and FA-4L (about 900 ft from IW-1). Ammonia concentrations above background levels have never been detected in the upper zone groundwater monitoring wells.

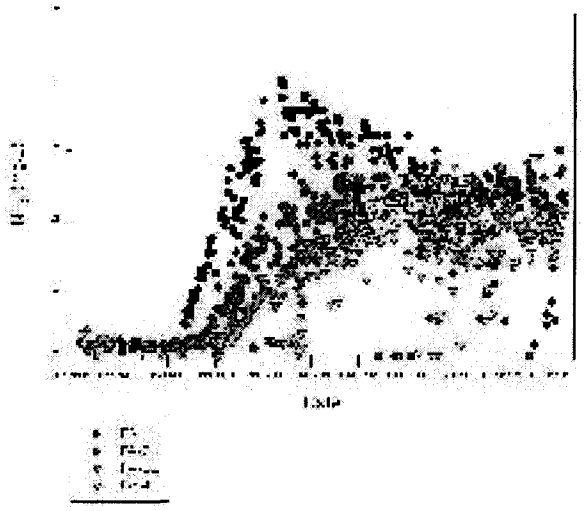

Figure 2. Ammonia concentrations for the four, lower zone groundwater monitoring wells.

Project Description and Objectives

In an effort to proactively manage and predict the future movement of the existing wastewater plume at the 1,500-foot depth, and to verify the integrity of the Middle Confining Unit, Miami-Dade County has proposed to FDEP the development of a numerical flow and solute transport model for the site. The FDEP has agreed to issue an operational permit for the NDWWTP provided Miami-Dade County moves forward with model development and a groundwater study (GWS) of the site. The USGS is currently developing a flow and transport model for the SDWWTP in southern Miami-Dade County and has agreed to develop a model for the NDWWTP following a similar approach. This proposal describes the USGS plan for completing a numerical investigation of groundwater flow and solute transport at the NDWWTP. In addition to describing the model development, this proposal also includes a water quality analysis to provide additional evidence regarding the cause of the wastewater plume.

The three specific objectives for the development of the numerical model to simulate groundwater flow and solute transport at the NDWWTP are as follows:

1. Estimate the current extent of the wastewater plume within the Upper Floridan Aquifer. This estimated extent will be used to determine the optimum location for installation of a ground-water monitoring well.
2. Predict future movement of the wastewater plume in the Upper Floridan Aquifer under a range of different injection scenarios. This information will be useful for managing future operations at the wastewater treatment facility.
3. Evaluate the integrity of the Middle Confining Unit, and thus the potential for upward fluid movement, by calibrating the variable-density flow and transport model to measured heads and salinities at the site.

PROPOSED MODELING STRATEGY

To achieve the project objectives, a three-dimensional variable-density ground-water flow and solute-transport model will be developed for the NDWWTP. The current plan is to use the SEAWAT computer program (Guo and Langevin, 2002; Langevin and others, 2004), which is a combined version of MODFLOW (McDonald and Harbaugh, 1988) and MT3DMS (Zheng and Wang, 1999). SEAWAT is capable of simulating advective and dispersive transport of multiple species in a three-dimensional, variable-density, ground-water flow system. Although SEAWAT is formulated for isothermal conditions, density is calculated as a function of total dissolved solids, or the concentration of any other chemical species. Like most commonly used ground-water modeling programs, SEAWAT is based on Darcy's Law and requires that model properties can be assigned using the assumption of an equivalent porous medium. Fortunately, Darcy's Law has proven valid for the Floridan aquifer (Hickey, 1984a); however the assumptions in SEAWAT will be evaluated as part of this project. If one or more of these assumptions are shown to severely limit applicability of the SEAWAT program for accurate predictions of injectate plume migration, another more complex code may be selected; however, it is unlikely that these assumptions would prevent the use of SEAWAT for this project.

One of the first steps in the model development is to collect and organize a wide range of subsurface information and historical injection records. This information will be used to prepare the hydrogeologic framework and fluid fluxes that will serve as input to the numerical model. Preliminary analyses using field data corrected for density-dependent conditions (Hickey, 1989b) will be used to estimate flow directions.

SEAWAT is a combined version of MODFLOW and MT3DMS, which means that datasets developed for SEAWAT can also be used directly in the standard versions of MODFLOW and MT3DMS. For the initial model runs, a short-term simulation period will be designed for calibrating hydrogeologic properties (hydraulic conductivity and specific storage). If computer runtimes permit, this initial calibration procedure will be performed using constant-density simulations and the observation, sensitivity, and parameter estimation processes in MODFLOW (Hill and others, 2000). The simulation period for this initial calibration will be based on pumping rates and completeness of the data record. Ideally, the initial calibration period will contain aquifer pressure buildup, similar to the conditions reported by Hickey (1984b) for a deep well injection site in St. Petersburg, Florida. Once the model is capable of representing the observed pressures in the injection and pumping wells (for a constant-density simulation), the model will be run in variable-density mode using SEAWAT. Some minor adjustments may be required to the calibrated hydraulic conductivity and specific storage distributions to account for the effects of density-dependent flow.

After the model is calibrated to flow parameters, a long-term variable-density simulation will be performed using the historical injection record. The long-term simulation will utilize the multi-species option in SEAWAT to track movement of total dissolved solids and ammonia. For this study, all species will be treated as conservative, and thus advection and dispersion are the only processes that will affect solute concentrations. During this long-term simulation, the transport parameters in the model (porosity and dispersivity) will be calibrated, and if necessary, the calibration of the flow parameters will be revised. The distributions for porosity and dispersivity will be

modified until the simulated concentrations match the concentrations in the observation wells. If possible, a parameter estimation program, such as UCODE (Poeter and Hill, 1998), will be used for this calibration procedure.

Data collected during installation of an additional monitoring well required under the agreement with FDEP will be used to refine the numerical model and develop a comprehensive predictive model. The comprehensive predictive model will contain all of the features of the preliminary model (multi-species transport, long-term simulation period, etc.), but will be improved with the new monitoring well data, and will be extended into the future to predict continued migration of the injected waters under a range of possible injection scenarios. Upon completion of the modeling objectives, a Water Resources Investigations Report will be written to document project findings.

MODELING TASK DESCRIPTIONS

As part of the agreement between FDEP and MDWASD, a task list and corresponding schedule was developed for the GWS (Table 1). A final, peer-reviewed Scientific Investigations Report will be published by the USGS approximately three years after project initiation, provided the project proceeds as outlined in Table 1 and FDEP requires only a single monitoring well. If additional monitoring wells are required with subsequent model recalibrations, the USGS agreement with MDWASD will be amended as appropriate.

Task 1. Effective Date of Permit Modification

Lead agency: MDWASD
Deadline: Project initiation (expected October 2006)
USGS deliverables: None
Task summary: This task marks the official start of the NDWWTP study, which corresponds to approval by DEP and MDWASD of the permit modification.

Task 2. Modeler and Model Selection

Lead agency: MDWASD and USGS
Deadline: Project initiation (expected October 2006)
USGS deliverables: The USGS will provide name of modeler and model code to MDWASD at onset of project.
Task summary: MDWASD is required to submit modeler's name and model software code to FDEP for approval. Provided this proposal is funded, the USGS will perform the modeling and will use the SEAWAT computer code.

Task 3. Data compilation

Lead agency: MDWASD and USGS
Deadline: Two months after approval of Task 2. USGS tasks may be delayed if MDWASD is delayed in locating and compiling historical site information.
USGS deliverables: Inventory of available data
Task summary: A significant amount of operational and hydrogeologic data is required to accurately simulate injectate migration. As part of this task, MDWASD will be

responsible for compiling and entering into spreadsheets all of the data that has been collected at the site. This data includes:

- historical injection rates and operating procedures,
- monitoring and injection well descriptions,
- chemistry of the injected waters,
- wellhead pressures,
- monitoring well chemistry,
- monitoring well pressures,
- monitoring well discharge histories,
- hydraulic or other test results at injection and monitoring wells, and
- lithologic and hydrogeologic descriptions.

The USGS will work with MDWASD to determine appropriate formats and the appropriate temporal resolution for the data. The USGS will be responsible for locating and compiling relevant reports and data from other deep well sites in Miami-Dade County and for preparing an inventory of existing data.

Task 4. Well location, design and construction and offsite well data collection

Lead agency: MDWASD
Deadline: Two months after Task 2 approval
USGS deliverables: None
Task summary: MDWASD will submit a proposal for design and construction of an offsite well.

Task 5. Develop conceptual model

Lead agency: USGS
Deadline: Four months after Task 2 approval
USGS deliverables: Presentation of conceptual model to MDWASD and FDEP
Task summary: Based on the data collected under Task 4, the USGS will formulate a conceptual model for the movement of injected waters. The USGS will also use analytical models or simple numerical models to identify the important hydrologic processes (advection, dispersion, density-driven flow, etc.).

Task 6. Calibrate and run preliminary model

Lead agency: USGS
Deadline: Five months after FDEP approval of Task 5
USGS deliverables: Presentation of preliminary model results to MDWASD and FDEP
Task summary: The conceptual model developed under Task 6 will be translated into a numerical model and calibrated with existing data. The calibration approach will be to select a part or all of the period since injection began and adjust parameters in the model until simulated pressures and concentrations match measured values at the monitoring and injection wells. If computer runtimes permit, a formal parameter estimation program, such as UCODE, will be used for the calibration procedure. If computer runtimes are prohibitively long, calibration will be performed using trial and error.

Task 7. Install and test monitor well(s)

Lead agency: MDWASD
Deadline: Eights months after FDEP approves Task 4
USGS deliverables: None
Task summary: Construct and test monitor well in accordance with Exhibit 1 of the permit modification.

Task 8. Data collection and analysis from monitor well

Lead agency: MDWASD
Deadline: Two months after completion of Task 7
USGS deliverables: None
Task summary: Collect and analyze sample data from monitoring well.

Task 9. Monitor well technical report

Lead agency: MDWASD
Deadline: Two months after completion of Task 8
USGS deliverables: None
Task summary: Submit to FDEP for approval a technical report with drilling results, geophysical results, lithological results and initial water quality results.

Task 10. Develop and run comprehensive predictive model

Lead agency: USGS
Deadline: Eighteen months after effective date
USGS deliverables: Informal presentation of modeling results to MDWASD
Task summary: The purpose of this task is to develop a comprehensive predictive model of the movement of injected waters. As part of this task, the numerical model will be updated as new information from the monitoring well installed as part of Task 7 becomes available.

Task 11. Presentation of model results and preliminary conclusions

Lead agency: USGS
Deadline: Four months after FDEP approves Task 10
USGS deliverables: Presentation of model results to FDEP
Task summary: The purpose of this task is to present preliminary results from the ground-water modeling activities of this project to FDEP and MDWASD. These results will be preliminary and not yet approved by the USGS.

Task 12. Ground Water Study report and recommendations

Lead agency: MDWASD
Deadline: Two months after Task 11
USGS deliverables: None
Task summary: MDWASD will submit a written report, based on the USGS presentation, and other available information.

WATER QUALITY ANALYSIS

The water quality analysis proposed here consists of sampling all the wells and the plant influent and effluent a single time (for a total of 15 samples). Each sample will be collected using strict USGS sampling protocol. The analyses performed on each sample will include tritium, helium, and the standard USGS schedule for wastewater compounds, which includes caffeine. The tritium and helium analysis will be performed by the laboratory at Lamont Dougherty under a contract with the USGS. The wastewater compound analysis will be performed by the USGS laboratory.

The tritium and helium analysis will be used to (1) re-confirm the initial geochemical results presented to the FDEP in the meeting on April 13, 2006, (2) determine the approximate age of the wastewater plume, and (3) determine if the plume was formed during a single event or if it formed as a result of gradual upward fluid movement through the confining unit. The wastewater compound analysis will be used to reaffirm that the ammonia plume at the 1,500-foot depth is from wastewater and not some other ammonia source in the Floridan Aquifer. For example, detection of caffeine in the 1,500-foot monitoring wells would confirm that elevated ammonia concentrations are due to the presence of wastewater.

RELEVANCE AND BENEFITS

Deep well injection has become a critical issue with the public in recent years, in large part due to concern and a general misunderstanding with regard to the use of the Floridan aquifer system for other uses including ASR and withdrawal with RO treatment. Deep well injection, ocean outfalls, and water reclamation represent the three alternatives for treated effluent that are currently being scrutinized by both the public and regulatory agencies. Deep well injection represents one of the more effective means of disposal, minimizing secondary effects to the environment or the reintroduction of contaminants into source water supply. This study is a first step in taking a detailed look at the Lower Floridan aquifer, including the Middle Confining Unit and Boulder Zone, in northern Miami-Dade County. This study will also look closer at the water quality in the area around the injection sites, and attempt to simulate the migration pathways of injected waters.

A significant quantity of data has been collected at the NDWWTP. Evaluation of the various types of data is often cumbersome, and in many cases, it's difficult to determine how one piece of information relates to another. A numerical model is a logical and straightforward way to integrate a wide range of seemingly disparate data into a single cohesive framework. The numerical will be useful, not only for making predictions about injectate movement, but also for evaluating the worth of existing data and for identifying data gaps. The geochemical analysis will provide a nice supplement to the flow and transport model. Although the use of caffeine as an anthropogenic indicator is conceptually straightforward, the full suite of wastewater compounds will further substantiate the conclusions from the water quality analysis by providing quantitative indicators. In addition, testing for multiple wastewater compounds will

improve the reliability of the results by providing a method to check for sample contamination.

REPORT

This project will be documented and described in a USGS Scientific Investigations Report. The report will be peer-reviewed prior to publication.

PERSONNEL

The personnel for this project will include four main specialists: a senior-level hydrogeologist and computer modeler, a staff hydrogeologist, a computer graphics analyst specializing in visualization of complex three-dimensional systems, and a water quality technician. The senior-level hydrogeologist will be responsible for directing the project, developing and calibrating the model, preparing the report, and presenting project findings. The staff hydrogeologist will locate and acquire data, and prepare the conceptual model for the site. The computer analyst will use computer software to perform complex interpolations in three dimensions, and to prepare three-dimensional graphical representations of the site geology, hydrogeology, and geochemistry. The water quality technician will collect the samples according to USGS protocol and ensure safe delivery to the appropriate laboratories.

BUDGET

Many of the tasks listed in this proposal are subject to approval by FDEP. This proposal was written under the assumption that FDEP would approve all tasks without delay. If delays result from the FDEP approval process, which has been common with the SDWWTP study, the USGS will require additional funding to support project personnel. Therefore, although FY 2010 has been calculated using half-time estimates, MDWASD and the USGS should anticipate a likely extension of funding and time.

	FY 2007	FY 2008	FY 2009	FY 2010	Total
USGS	$100,000	$100,000	$100,000	$0	$300,000
MDWSD	$251,264	$194,350	$155,182	$151,310	$752,107
Total	$351,264	$294,350	$255,182	$151,310	$1,052,107

The USGS matching share is dependent on the availability of the Federal/State Cooperative Program funds.

REFERENCES

Guo, Weixing, and Langevin, C.D., 2002, User's guide to SEAWAT: A computer program for simulation of three-dimensional variable-density ground-water flow: U.S. Geological Survey Techniques of Water-Resources Investigations, book 6, chapter A7, 77 p.

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Singh, U.P. and Sproul, C.R., 1980, Geotechnical investigations during drilling of a deep disposal well in Dade County, Florida: *Ground Water* vol. 18, no. 5:498-502.

Zheng, Chunmiao, and Wang, P.P., 1999, MT3DMS—A modular three-dimensional multispecies transport model for simulation of advection, dispersion and chemical reactions of contaminants in ground-water systems; documentation and user's guide: U.S. Army Corps of Engineers Contract Report SERDP-99-1.

Table 1. Task list and schedule for the Ground Water Study. USGS tasks are highlighted in yellow. Note that the actual due dates are subject to change, in which case, the USGS will use the # of months from the initiation of the USGS/MDWASD project (expected March 1, 2007).

Task	Item	Activity	Deadline	Due Date	FDEP Action	Estimated # of months after FDEP Action
1	Effective date of permit with Administrative Order (AO)	Permit and AO received	Time zero	**8/10/06**	Permit and AO issuance	0
2	Modeler and model selection; definition of model purpose	Submit modeler's name, model software code, and definition of model purpose for FDEP approval	**One month after AO received**	9/10/06	FDEP Approval required - expected **10/10/06**	2
3	Data compilation	Collection of existing data needed to build model	Two months after Task 2 approval	12/10/06	No FDEP approval required	4
4	Well location, design and construction and offsite well data collection	Submit proposal for well location, design, construction and offsite data collection (lithological, geophysical, geochemical, and water quality)	Two months after Task 2 approval	12/10/06	FDEP Approval required - expected **1/10/07**	5
5	Develop Conceptual model	Submit Conceptual model to FDEP for approval	four months after Task 2 approval	2/10/07	FDEP Approval required - expected **3/10/07**	7
6	Calibrate and run initial iteration	Submit preliminary model results	five months after FDEP approves Task 5 – 1 year after effective permit date	**8/10/07**	FDEP Approval required – expected **9/10/07**	13
7	Install and test monitor well(s)	Construct and test monitor well(s)	Eight months after FDEP approves Task 4	9/10/07	No FDEP approval required	13
8	Data collection and analysis from monitor well	Complete collection and analysis of sample data from monitoring well(s)	Two months after completion of Task 7	11/10/07	No FDEP approval required	15
9	Monitor well technical report	Submit to FDEP for approval a technical report with drilling results, geophysical results, lithological results and initial water quality results	Two months after completion of Task 8	1/10/08	FDEP Approval required - expected **2/10/08**	18
10	Develop and run comprehensive predictive model	Run model using data from monitor wells and prepare information for making presentation	eighteen months after effective date of AO	**2/10/08**	FDEP Approval required - expected **3/10/08**	19
11	Presentation of model results and preliminary conclusions	Permittee and selected modeler present model's preliminary results and conclusions to FDEP	Four months after FDEP approves Task 10	7/10/08	FDEP Approval required - expected **8/10/08**	24
12	Ground Water Study report and recommendations	Permittee submits written report based on modeler's presentation and other available information, including proposal for additional monitoring well(s) to FDEP for approval	Two months after Task 11	10/10/08	FDEP Approval required - expected **11/10/08**	27
	Model iteration using data from additional monitoring well(s)	Repeat Tasks 7-12, as necessary, for successful completion of the model	Same time period as provided for Tasks 7-12			Each model iteration would extend the timeframe for final completion of the GWS

ORIGINAL

Form 9-1366
(Oct. 2005)

U.S. Department of the Interior
U.S. Geological Survey
Joint Funding Agreement

Customer #:	FL016
Agreement #:	07E0FL208003
Project #:	7-2080-B8W01
TIN #:	59-6000573
Fixed Cost Agreement	☑ Yes ☐ No

FOR
WATER RESOURCES INVESTIGATION

THIS AGREEMENT is entered into as of the 01 day of October, 2006, by the U.S. GEOLOGICAL SURVEY, UNITED STATES DEPARTMENT OF THE INTERIOR, party of the first part, and the MIAMI-DADE COUNTY WATER AND SEWER DEPARTMENT, party of the second part.

1. The parties hereto agree that subject to availability of appropriations and in accordance with their respective authorities there shall be maintained in cooperation A MIAMI-DADE NORTH DISTRICT WASTE WATER TREATMENT PLANT GROUND-WATER STUDY, herein called the program. The USGS legal authority is 43 USC 36C; 43 USC 50; and 43 USC 50b.
2. The following amounts shall be contributed to cover all of the cost of the necessary field and analytical work directly related to this program. 2(b) includes In-Kind Services in the amount of $0.00.

by the party of the first part during the period

(a) $300,000.00 October 01, 2006 **to** September 30, 2010

by the party of the second part during the period

(b) $752,107.00 October 01, 2006 **to** September 30, 2010

(c) Additional or reduced amounts by each party during the above period or succeeding periods as may be determined by mutual agreement and set forth in an exchange of letters between the parties.

(d) The performance period may be changed by mutual agreement and set forth in an exchange of letters between the parties.

3. The costs of this program may be paid by either party in conformity with the laws and regulations respectively governing each party.
4. The field and analytical work pertaining to this program shall be under the direction of or subject to periodic review by an authorized representative of the party of the first part.
5. The areas to be included in the program shall be determined by mutual agreement between the parties hereto or their authorized representatives. The methods employed in the field and office shall be those adopted by the party of the first part to insure the required standards of accuracy subject to modification by mutual agreement.
6. During the course of this program, all field and analytical work of either party pertaining to this program shall be open to the inspection of the other party, and if the work is not being carried on in a mutually satisfactory manner, either party may terminate this agreement upon 60 days written notice to the other party.
7. The original records resulting from this program will be deposited in the office of origin of those records. Upon request, copies of the original records will be provided to the office of the other party.

ORIGINAL

Page 2 of 2

Form 9-1366 continued	U.S. Department of the Interior U.S. Geological Survey Joint Funding Agreement	Customer #: Agreement #: Project #: TIN #:	FL016 07E0FL208003 7-2080-B8W01 59-6000573

8. The maps, records, or reports resulting from this program shall be made available to the public as promptly as possible. The maps, records, or reports normally will be published by the party of the first part. However, the party of the second part reserves the right to publish the results of this program and, if already published by the party of the first part shall, upon request, be furnished by the party of the first part, at costs, impressions suitable for purposes of reproduction similar to that for which the original copy was prepared. The maps, records, or reports published by either party shall contain a statement of the cooperative relations between the parties.
9. USGS will issue billings utilizing Department of the Interior Bill for Collection (form DI-1040). Billing documents are to be rendered **QUARTERLY**. Payments of bills are due within 60 days after the billing date. If not paid by the due date, interest will be charged at the current Treasury rate for each 30 day period, or portion thereof, that the payment is delayed beyond the due date. (31 USC 3717; Comptroller General File B-212222, August 23, 1983).

U.S. Geological Survey
United States
Department of the Interior

MIAMI-DADE COUNTY WATER AND SEWER DEPARTMENT

USGS Point of Contact

Name: Jean Happel, A.O.
Address: 3110 S.W. 9th Ave.
Ft. Lauderdale, FL 33315

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Email: jhappel@usgs.gov

Customer Point of Contact

Name: Virginia Walsh, P.G.
Address: 3071 S.W. 38th Ave.
Room 554-10
Miami, FL 33146
Telephone: 786/552-8266
Email:

Signatures

By_____ Date_____
Name: Dr. Barry Rosen
Title: FISC Director

By_____ Date_____
Name:
Title:

By_____ Date_____
Name:
Title:

Signatures

By_____ Date_____
Name:
Title:

By_____ Date_____
Name:
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By_____ Date_____
Name:
Title: